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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/658,711	09/08/2003	Avetik Harutyunyan	23085-08273	6981

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EXAMINER

GAMBETTA, KELLY M

ART UNIT	PAPER NUMBER
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1792

NOTIFICATION DATE	DELIVERY MODE
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02/04/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/658,711	Applicant(s) HARUTYUNYAN, AVETIK	
	Examiner KELLY GAMBETTA	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114 was filed in this application after a decision by the Board of Patent Appeals and Interferences, but before the filing of a Notice of Appeal to the Court of Appeals for the Federal Circuit or the commencement of a civil action. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 22 January 2010 has been entered.

Response to Arguments

Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "the metalorganic layer". There is insufficient antecedent basis for this limitation in the claim.

Claim 1 recites the limitation "the organic portion". There is insufficient antecedent basis for this limitation in the claim.

Claim 2 recites the limitation "the metalorganic layer ". There is insufficient antecedent basis for this limitation in the claim.

Claim 3 recites the limitation "the metalorganic layer. There is insufficient antecedent basis for this limitation in the claim.

Claim 4 recites the limitation "the deposited metalorganic layer ". There is insufficient antecedent basis for this limitation in the claim.

Claim 9 recites the limitation "the metalorganic layer". There is insufficient antecedent basis for this limitation in the claim.

Claim 10 recites the limitation "the metalorganic layer". There is insufficient antecedent basis for this limitation in the claim.

Claim 11 recites the limitation "the growth catalyst". There is insufficient antecedent basis for this limitation in the claim.

Claim 16 recites the limitation "the metalorganic substance" and "the metalorganic layer". There is insufficient antecedent basis for this limitation in the claim.

Claim 17 recites the limitation "the metalorganic layer". There is insufficient antecedent basis for this limitation in the claim.

These instances of improper antecedent basis and any other similar instances require correction. Any claims not mentioned here are rejected due to their dependency on a rejected base claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 3-15, and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over US patent number 6232706 to Dai et al. in view of US Patent publication 2002/0036452 A1 to Muroyama et al. and in further view of Smalley et al. (US 6692717)

With regard to claims 1 and 11, Dai et al. includes a method for synthesizing carbon nanostructures including providing a substrate having a deposition mask

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(column 3 lines 57-59), depositing an Fe layer on a on an unmasked portion of the substrate, removing the mask (shadowmask 48 in Figure 3) oxidizing the Fe layer to form a growth catalyst then exposing the substrate to a carbon precursor gas at a deposition temperature to form carbon nanostructures (columns 3 and 4 lines 44-10). Dai also teaches that the oxidizing agent is air in columns 3-4 lines 45-10. Dai et al. does not include using an organometallic Fe layer instead of only Fe. Muroyama et al. discloses using a metalorganic layer (paragraph 0050 and examples 11 and 12) that may include a Fe metalorganic layer (paragraph 0098) as a catalyst layer for depositing carbon nanostructures deposited by PVD or CVD (paragraph 0097) to improve the carbon nanofilm/nanostructures grown in the property of selective growth (paragraph 0050). It follows that the organic portion of these precursors will be volatized as the final catalyst layer is a metal/metal oxide.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Dai et al. to include metalorganic Fe instead of just Fe as taught by Muroyama et al. in order to improve the carbon nanofilm/nanostructures grown in the property of selective growth.

Dai et al. and Muroyama et al. do not teach that the catalyst may be bimetallic or trimetallic. Smalley et al. teaches using bimetallic or trimetallic catalysts that contain iron that will eventually be met with an oxidizing atmosphere and will be used to grow carbon nanostructures (column 6 lines 30-67 and column 7 lines 1-12). Smalley et al. teaches that these types of catalysts are advantageous in the formation of carbon

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nanostructures because it allows for more control over the growth of single walled nanotubes (abstract and above cited section).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Dai et al. and Muroyama et al. to include using bimetallic or trimetallic catalysts as taught by Smalley et al. in order to attain more control over the growth of single walled nanotubes.

With regard to claim 3, Dai et al. discloses using a physical vapor deposition process to deposit iron (column 5 lines 44-47), which would deposit the metalorganic when combined with Muroyama et al.

With regard to claim 4, the thicknesses of the layers in Muroyama et al. depend upon the desired device characteristics. One of ordinary skill in the art would recognize that an electron emission device would have layers with thicknesses in the micron range. Additionally, it would have been obvious to one of ordinary skill in the art to modify the thickness of the metalorganic layer between 1-30 microns as claimed depending on the desired device characteristics absent evidence showing criticality for the claimed values.

Regarding claims 5-6, Muroyama et al. discloses the mask to be aluminum oxide in paragraphs 0096 and 0099.

Regarding claims 7 and 8 the substrate is composed of silicon oxide in Dai et al. column 3 lines 60-65.

Regarding claims 9 and 10 Dai et al. discloses the substrate annealed in an oxidizing atmosphere at 300 °C overnight (column 3 lines 59-60). One of ordinary skill

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in the art would recognize that if a shorter time was desired, the temperature should be increased, or if the temperature were decreased the annealing would take longer.

Therefore these values are by routine experimentation and are not inventive. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Dai et al. to include annealing the iron in an oxidizing atmosphere from 2-4 hrs at 450-500 °C depending on the time and temperature requirements of the system absent evidence showing a criticality for the claimed values. Further, the organic portion of the layer must be vaporized as when the layer is used as a catalyst, only a metal/metal oxide remains as the layer. It is also noted that the temperature will also depend upon the volatility of the organic component.

With regard to claims 12-14, Dai et al. discloses the exposure to carbon precursor gases 15-60 minutes in column 4 lines 2-4 and Muroyama et al. discloses using methane, hydrogen and argon to deposit carbon nanotubes to stabilize the gases and possible plasma discharge and deposit carbon nanotubes (paragraph 0103).

Regarding claim 15, Dai et al. discloses the deposition temperature of ethylene as a precursor gas at 700 °C (column 4 lines 1-3).

Regarding claim 17, Dai et al. uses the mask to pattern the substrate as shown in Figure 3, shadowmask 48. The mask is present during step B, the deposition of the organometallic material, and is not present during step C when the carbon is deposited. One of ordinary skill in the art would realize that removing the mask before or after the oxidation of the organometallic material would not make a difference in the procedure or Dai et al. as long as it was removed before the deposition of the carbon. Therefore, it

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would have been obvious to one of ordinary skill in the art to remove the mask before or after oxidation of the organometallic material in order to allow the carbon to be deposited.

Regarding claims 18 and 19, Dai et al. shows single walled 1D carbon nanotubes in Figure 3, reference number 28 and describes the nanotubes in columns 1 and 2 et seq.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. in view of Muroyama et al. and Smalley et al. as applied above, and further in view of US patent number 5863601 to Kikuchi et al.

Dai et al., Muroyama et al. and Smalley et al. include the limitations of claim 2 as discussed above except for using iron phthalocyanine as the metalorganic layer. Kikuchi et al. teaches using metalorganic material to be composed of Fe and phthalocyanine when forming carbon nanotubes in order to use a compound that will be useful in both CVD and PVD (column 2 lines 60-66).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Dai et al., Muroyama et al. and Smalley et al. to include iron phthalocyanine as the metalorganic layer as taught by Kikuchi et al. in order to use a compound that will be useful in both CVD and PVD.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. in view of Muroyama et al. and Smalley et al. as applied above, and further in view of US Patent 4650895 to Kadokura et al.

Dai et al., Muroyama et al. and Smalley et al. include the provisions of claim 16 except purifying the organometallic compound before use. Kadokura et al. teaches purifying an organometallic compound before use with a procedure that could be used with the method of Dai et al., Muroyama et al. and Smalley et al. in order to remove impurities from the organometallic compound and prevent unwanted reaction products (column 1 lines 1-45).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Dai et al., Muroyama et al. and Smalley et al. to include purifying the organometallic substance before use as taught by Kadokura et al. in order to remove impurities from the organometallic compound and prevent unwanted reaction products.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KELLY GAMBETTA whose telephone number is (571)272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kelly M Gambetta/
Examiner
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kmg